

## Proof of Program - 2017 to 2019



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of Transportation

**Federal Highway  
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Prepared for

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## Contents

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<b>1</b>	<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>2</b>	<b>HISTORY .....</b>	<b>3</b>
<b>3</b>	<b>PROOF OF PROGRAM OVERVIEW .....</b>	<b>4</b>
<b>4</b>	<b>BETA TESTERS .....</b>	<b>6</b>
<b>5</b>	<b>PERMIT ACTIVITY .....</b>	<b>7</b>
<b>6</b>	<b>DATA COLLECTION DETAILS .....</b>	<b>9</b>
<b>7</b>	<b>BETA TESTER FEEDBACK .....</b>	<b>27</b>
<b>8</b>	<b>LESSONS LEARNED .....</b>	<b>28</b>
<b>9</b>	<b>RECOMMENDATIONS.....</b>	<b>29</b>
9.1	Address Remaining Improvements in the MDOT GUIDE Web Portal .....	29
9.2	Proposed GUIDE Quick Reference Sheet .....	33
9.3	Proposed Updates to the Draft GUIDE Procedural Manual .....	35
<b>10</b>	<b>PROOF OF PROGRAM SUMMARY .....</b>	<b>36</b>
<b>Appendix A - Beta Testing &amp; Early Adopter Program Documents .....</b>		<b>Appendix 2</b>
<b>Appendix B - Beta Tester Survey .....</b>		<b>Appendix 7</b>
<b>Appendix C - Permit Attachment .....</b>		<b>Appendix 14</b>
<b>Appendix D - SHRP2 Application .....</b>		<b>Appendix 16</b>
<b>Appendix E - Bug &amp; Enhancement List .....</b>		<b>Appendix 26</b>

# 1 EXECUTIVE SUMMARY

In the Spring of 2017, MDOT embarked on the third phase of Geospatial Utility Infrastructure Data Exchange (GUIDE), the Proof of Program, with the intent of testing and proving validity of the draft GUIDE Procedural Manual (the Manual). GUIDE's Proof of Program is funded by the second Strategic Highway Research Program (SHRP2) which is a national partnership of the Federal Highway Administration, AASHTO, and the Transportation Research Board. MDOT was awarded \$150,000 for the Proof of Program phase.

The **primary goals** of the Proof of Program were to collect a significant amount of field data consisting of a variety of different utilities and installation methods and concurrently validate the GUIDE Manual and processes.

The goals would be accomplished through the following tasks:

- Establish a data flow of utility installation permits from MDOT Transportation Service Centers (TSC) to the primary consultant, Prein&Newhof (P&N).
- Distribute GUIDE permits to P&N surveyors or volunteer surveyors (beta testers) for field data collection.
- Test the direct and indirect observation methods of collecting survey data as outlined by the Manual and document field activities through photographs, notes and observations.
- Review the Manual for accuracy, readability and general content.
- Test the Collector for ArcGIS Application and the upload/download functionality of the MDOT GUIDE Web Portal, herein referred to collectively as the GUIDE software applications.

The **roles and objectives** of the GUIDE Proof of Program were outlined as follows:

- P&N was to serve as primary clearinghouse for permits coming from the TSCs, perform field data collection, validate the Manual, and test the GUIDE software applications.
- P&N would distribute permits, provide technical support and oversight to a group of beta testers, garner feedback from the beta testers on the Manual and GUIDE software applications, and review submitted data for quality assurance.
- Spicer Group, the primary consultant for the GUIDE pilot initiative (phase I) and Manual development (phase II), would provide continued technical support through testing of the GUIDE software applications and limited survey data collection.
- The MDOT TSC's would send underground utility permits to P&N.

MDOT and Spicer Group held training which covered the types of field survey (direct and indirect) as well as the two primary data collection methods; traditional survey and the ArcGIS for Collector application. Following the training, surveyors from P&N and beta testers began data collection efforts.

Data collection commenced in the late Spring and continued into the Summer of 2017. P&N reviewed 183 permits received from TSCs. Turning permits into actionable data collection possibilities proved difficult due to a number of factors including miscommunication from contractors and/or the permit applicant, permit work completed prior to listed install dates, and permits that did not meet minimum GUIDE standards for data collection. Eleven of the permits turned into actual data collection efforts; eight were completed by P&N and three by beta testers. Despite these challenges, 242 field observations were captured representing 55 utility line segments totaling 8,587 linear feet. Beta testers from OHM Advisors, Johnson & Anderson, and Surveying Solutions, Inc. (SSI) contributed data and provided feedback on the Manual and GUIDE software applications.

Data collection continued in 2018 after a refinement in the process of permit reviews based on location. In an effort to successfully identify ideal utility installations for data collection, focus turned to permits originating from six TSCs in close proximity to the three P&N offices and installations of a significant duration of schedule. P&N reviewed ten permits in 2018. Data was collected on four utility installations; three local agency projects and one permitted installation. Testing of the GUIDE software applications continued as bugs were eliminated, enhancements were validated, and recommendations were proposed for future improvements.

The GUIDE Proof of Program successfully accomplished the following goals:

- Data collection of a variety of utilities and utility installation types.
- Review and validation of the GUIDE Procedural Manual.
- Validation of the Process.
- Testing and refinement of the GUIDE software applications which resulted in the elimination of several bugs and identification of future enhancements.

## 2 HISTORY

In 2013 the Michigan Utility Coordination Committee (MUCC), under MDOT's leadership, partnered with AT&T, Consumers Energy, DTE Energy, MISS DIG and the Michigan Infrastructure and Transportation Association to start a pilot focused on acquiring accurate 3D geospatial utility information during the time of the utility's installation. The goal was to develop the framework for a program that lays the foundation for capturing accurate survey and attribute data on utilities at the time of installation. Accurate survey data was collected on the installed utilities in accordance with guidance standards developed by the MUCC.

The pilot proved to be very successful. Lessons were learned, best practices were shared and keys to moving forward were documented. Thanks to the Federal Highway Administration's (FHWA) State Transportation Innovation Council (STIC) funding, the [GUIDE Pilot Report](#) captured the results of the MUCC's GUIDE pilot.

In 2015, MDOT secured its second round of STIC funding to further advance GUIDE development. The goal was to develop a comprehensive procedural manual and draft standards that would support statewide implementation of GUIDE. The data standards are built on industry standard GIS format (shapefile) and encompass all utility types tracked by MISS DIG.

The published 2017 draft [GUIDE Procedural Manual](#) was developed with input from AT&T, Consumers Energy, DTE Energy, MISS DIG, MDOT, MUCC and Spicer Group. These standards have been developed from the roadway agency perspective, keeping attribution details to a minimum to avoid the possibility of recording what may be considered by some as sensitive information. The data standards have been developed in a way that any utility owner can integrate the data collected into their existing enterprise GIS.

The standards were developed to support permitted underground utility installations. However, the standards are robust enough to support program-wide as-builts for MDOT, including collection during construction projects. The standards are comprehensive and facilitate the capture of accurate XYZ information, including utility type, utility size, and utility owner at the time of installation.

### 3 PROOF OF PROGRAM OVERVIEW

The GUIDE Proof of Program began in 2017 with the primary goal of data collection and validation of the Manual. P&N was to serve as the primary data collection firm and in an effort to broaden the scope and reach of the program, beta testers were invited to participate. MDOT solicited interest from engineering and surveying companies to voluntarily participate in testing GUIDE data collection standards, reviewing the Manual and completing a user survey.

The Proof of Program began with a kickoff meeting held May 16, 2017 at the MDOT Grand Rapids Region Office. Representatives from Prein&Newhof, Spicer Group and MDOT were present.

The workflow of the GUIDE Proof of Program outlined during the meeting as follows:

- MDOT TSC's were to forward permits to P&N for review. P&N would determine if the permits met GUIDE data collection criteria.
- P&N would distribute permits meeting GUIDE criteria to one of three P&N offices (Grand Rapids, Cadillac and Kalamazoo) or to one of the twelve beta testers for data collection.
- Surveyors from P&N and beta testers would perform field data collection, and in doing so validate the Manual and test the GUIDE software applications.
- P&N would provide technical support and oversight to beta testers and garner feedback from them on the Manual and GUIDE software applications.
- P&N would review submitted data for quality assurance.
- Spicer Group, the primary consultant for the draft GUIDE procedural manual, would provide continued technical support through application testing and limited survey data collection.

On May 23, 2017 MDOT and Spicer Group held training for P&N and beta testers as part of the [Beta Testing & Early Adopter Program](#). The goal of the Beta Testing & Early Adopter Program was to engage a group of survey firms in vetting the GUIDE Procedural Manual. The attendees included surveyors from P&N, ten engineering/surveying firms, and two utilities. The training covered the types of field survey observations (direct and indirect) as well as the two data collection methods; conventional survey and the ArcGIS for Collector application.

The flow of permits was also explained. After review by P&N, permits meeting GUIDE criteria would be distributed to either P&N surveyors or interested beta testers if a permit was in close proximity to their office location. The surveyors would then collect data using one of the two data collection methods as outlined in the Manual. P&N would then work with Spicer Group

and MDOT to evaluate the data, identify bugs, and work through any issues pertaining to the GUIDE software applications.

In addition to distributing permits and performing data collection, P&N served as technical support for the beta testers if problems were encountered in the field or while uploading data. P&N issued short feedback surveys to each beta tester to garner their input on the Manual and GUIDE software applications. The results of those surveys were compiled and are covered in [Section 7](#). The survey is included in [Appendix B](#).

With the P&N and Early Adopter training complete, the focus of GUIDE shifted into data collection in 2017 and 2018. Data collection efforts were intended to collect portions of utility installations and not a complete project from start to finish. The goal of the data collection efforts during the Proof of Program was to sample as many permit installations as possible and capture data on a variety of utility types and installation methods. In regards to utility types, data was collected on storm, sanitary, water, gas, communications and steam systems. Installation methods encountered included open cut, boring and horizontal directional drilling (HDD).

[Sections 5](#) & [6](#) of this report detail permit activity and the results of data collection efforts.



## 4 BETA TESTERS

In an effort to introduce the Manual and GUIDE software applications to a larger audience, MDOT solicited interest from the surveying community in Michigan for participation in the Proof of Program. The Solicitation of Interest document in [Appendix A](#) was sent to all MDOT pre-qualified surveying firms. Participation was voluntary and not compensated. Beta testers were asked to attend the GUIDE Data Collection Training and spend approximately two to three hours on a data collection effort in close proximity to their office. The following companies were represented at the GUIDE Data Collection Training:

Consumers Energy	Mannik & Smith
DTE Energy	OHM Advisors
Fishbeck Thompson Carr & Huber	ROWE Professional Services Company
Fleis & Vandenbrink	Spalding DeDecker
Gourdie Fraser	Surveying Solutions, Inc.
Johnson&Anderson	Wade Trim

Surveyors from OHM Advisors, Surveying Solutions, Inc., and Johnson&Anderson each completed a data collection effort and submitted responses to a follow-up survey. Through their contributions, the beta testers confirmed several issues encountered by P&N including data collection coordination challenges with utility installations and difficulties with the .CSV file upload process.

## 5 PERMIT ACTIVITY

MDOT TSCs forwarded 183 permits to P&N for consideration in 2017 and 10 in 2018. Permits that did not meet the GUIDE data collection criteria were removed from consideration. Table 1 summarizes the permits received for each year.

**Table 1: Permit Summary - 2017 & 2018**

	2017	2018
<i>Permit Work Completed – various reasons</i>	<i>116</i>	<i>6</i>
Not enough notice	20	
Does not meet GUIDE Utility Requirements	11	
Beta Tester unable to collect at site	2	
On Hold	4	
No response from Utility	13	2
Cancelled Installation	2	
Ongoing MDOT ITS Installation	1	
Permit Work Completed, Data Collected	11	1
Installation to be Completed Later	2	1
In Progress, No Anticipated End Date	1	
<b>Total</b>	<b>183</b>	<b>10</b>
<b>Local Agency Jobs</b>	<b>3</b>	<b>4</b>

A majority of utility companies performed their installation work outside of the window of time indicated in their permit application. Field installation dates often did not correspond to the information on permits. A variety of reasons were given by the utility companies as to the cause for the change of their install date; weather, site conditions, delays on previous installs, earlier completion on other projects, change in priority of their work, material availability, and crew availability.

Communication, a key to timing data collection with utility installations, proved to be a challenge. Missed attempts to collect data in the field by the P&N surveyors were frequent due to the installation schedule changes without notification to P&N.

Another substantial challenge proved to be educating utilities on why P&N would be collecting data at their installation site. MDOT created a [permit attachment](#) with the intention of educating contractors on the specifics of GUIDE. Some contractors still voiced concerns of being “inspected and monitored”, however these concerns lessened as the year went on if the applicant had multiple permits and was familiar with GUIDE.

Table 2 shows the number of permits submitted by each TSC for 2017 and 2018. After refinement of the process of permit review based on location was made by the team in 2018, only six TSCs were asked to submit potential installation permits.

**Table 2: Permits Received by TSC**

<b>MDOT TSC</b>	<b>2017</b>	<b>2018</b>
Bay City	16	
Brighton	31	
Cadillac	11	1
Gaylord	21	
Grand Rapids	17	1
Kalamazoo	21	1
Lansing	3	
Macomb	2	
Marshall	25	
Mt. Pleasant	5	
Muskegon	11	1
Traverse City	20	6
<b>Total</b>	<b>183</b>	<b>10</b>

Table 3 shows the total number of permits by utility type for both 2017 and 2018. The vast majority were communication facility installations.

**Table 3 Permits by Utility Type**

<b>Utility</b>	<b>2017</b>	<b>2018</b>
Communications	138	
Gas	12	8
Municipal	12	2
Electric	11	
Misc.	7	
MDOT	2	
CRC	1	
<b>Total</b>	<b>183</b>	<b>10</b>

## 6 DATA COLLECTION DETAILS

In 2017 and 2018, 242 observations totaling 8,587 linear feet of underground utilities were collected and uploaded into the MDOT GUIDE Web Portal. P&N collected 206 of those observations totaling 7,728 feet while beta testers from Johnson & Anderson, Surveying Solutions, Inc. (SSI) and OHM Advisors contributed 26 observations totaling 284 feet. As part of the MDOT GUIDE Web Portal testing, Spicer Group uploaded 10 observations comprising 224 feet of storm sewer.

Figure 1 indicates the geographic distribution of data collection efforts. The geographic distribution of the Proof of Program data collection focused on the Grand Rapids, Cadillac and Kalamazoo areas due to the close proximity to P&N offices. Data collection locations shown with a red circle correspond to those completed by P&N while the blue circles indicate data collection completed by beta testers. The numbers shown on the map correspond to the “Data Collection #” included on the detailed pages that follow in this section.

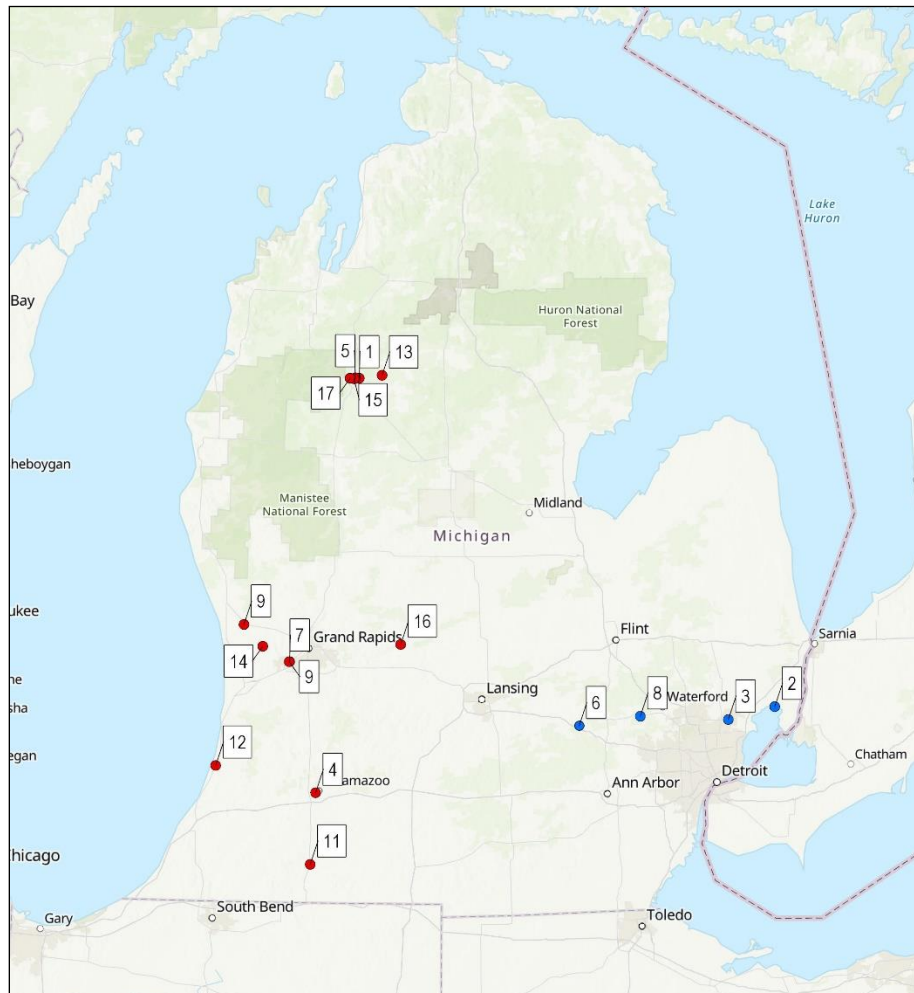


Figure 1: Data Collection Locations

Data Collection #1		City of Cadillac, Wexford County
Location:	38 Rd, Cadillac, MI	
Utility Company Name:	City of Cadillac	
MDOT Permit Number (if applicable):	N/A	
Date of Data Collection:	7/14/2017	
Feature Type:	Water	
Utility Diameter:	8"	
Installation Method:	Open Cut	
Survey Company:	Prein&Newhof	
Data Collection Method:	Conventional Survey	
Equivalent SUE Quality Level:	A	
Observations:	4	
Total Linear Feet Surveyed:	76	





Data Collection #2		Ira Township, St. Clair County
Location:	M-29 (Dixie Highway)	
Utility Company Name:	New Baltimore City	
MDOT Permit Number (if applicable):	N/A	
Date of Data Collection:	7/14/2017	
Feature Type:	Storm	
Utility Diameter:	15"	
Installation Method:	Open Cut	
Survey Company:	Spicer	
Data Collection Method:	Collector for ArcGIS	
Equivalent SUE Quality Level:	A	
Observations:	10	
Total Linear Feet Surveyed:	224	

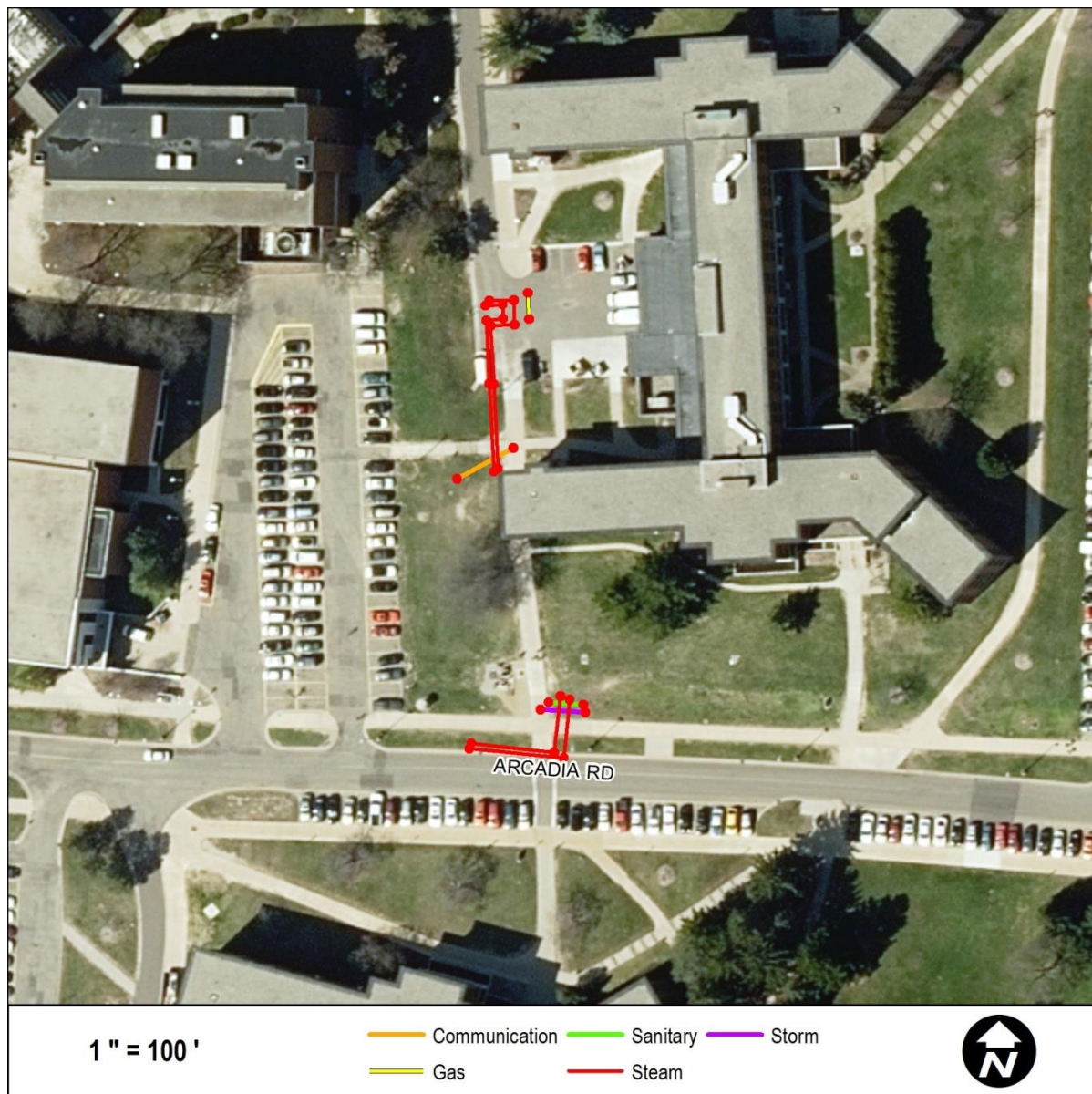


Data Collection #3		Macomb Township, Macomb County
Location:	M-59 (Hall Road)	
Utility Company Name:	Consumers Energy	
MDOT Permit Number (if applicable):	47083	
Date of Data Collection:	6/28/2017	
Feature Type:	Gas	
Utility Diameter:	6"	
Installation Method:	Open Cut	
Survey Company:	SSI	
Data Collection Method:	Collector for ArcGIS	
Equivalent SUE Quality Level:	A	
Observations:	4	
Total Linear Feet Surveyed:	20	



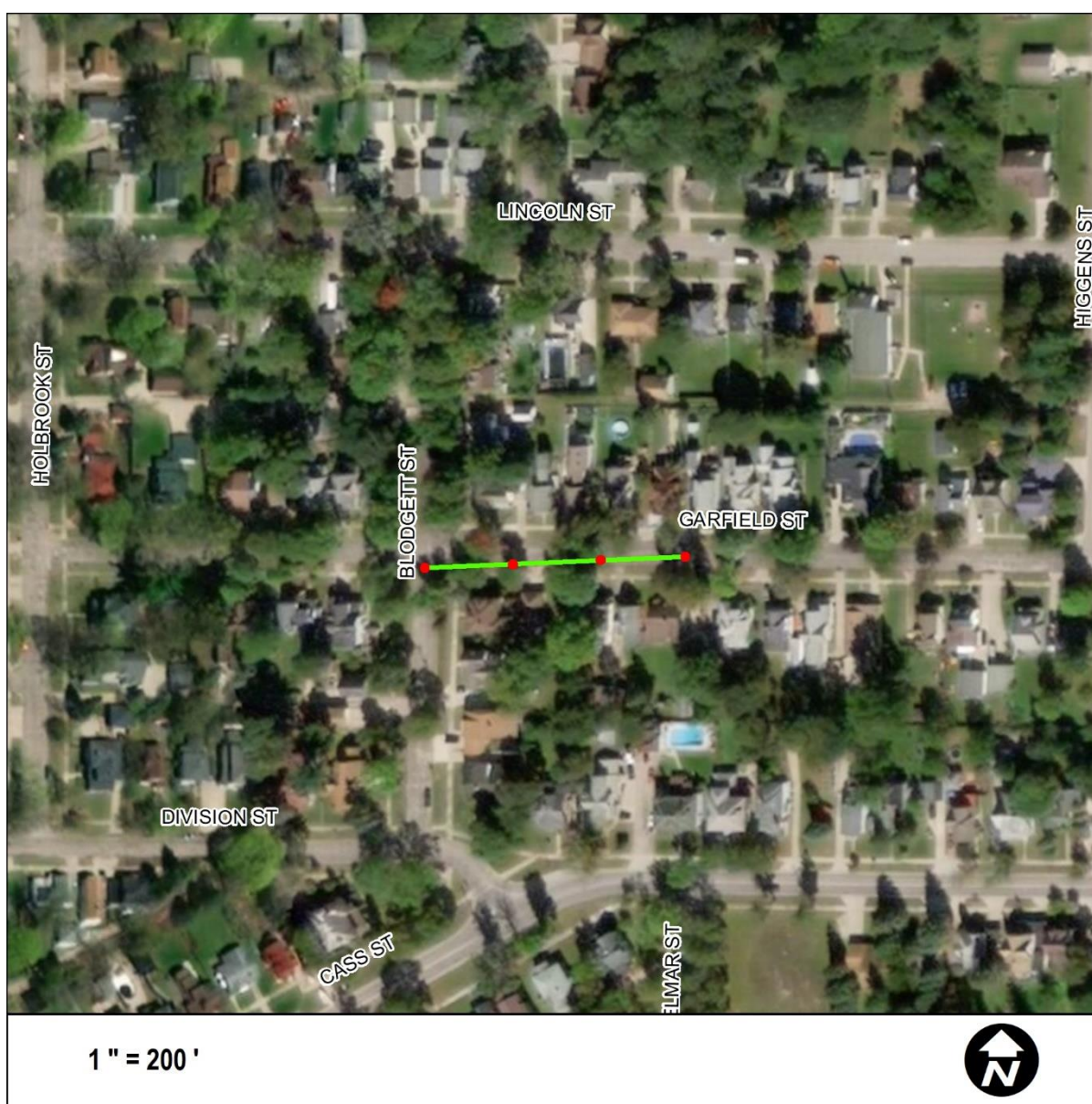


Data Collection #4		City of Kalamazoo, Kalamazoo County
Location:	Arcadia Road, Campus of Western Michigan University	
Utility Company Name:	Western Michigan University	
MDOT Permit Number (if applicable):	N/A	
Date of Data Collection:	7/26/2017	
Feature Type:	Sanitary, Steam, Stormwater, Gas, Communications	
Utility Diameter:	San. (12"), Steam (4", 6", 12", 24"), Storm (24"), Comm. (1"), Gas (1")	
Installation Method:	Open Cut (Sanitary, Steam, Stormwater), Discovered (Gas, Communications)	
Survey Company:	Prein&Newhof	
Data Collection Method:	Collector for ArcGIS	
Equivalent SUE Quality Level:	A	
Observations:	26	
Total Linear Feet Surveyed:	503	





Data Collection #5		City of Cadillac, Wexford County
Location:	Garfield Street	
Utility Company Name:	City of Cadillac	
MDOT Permit Number (if applicable):	N/A	
Date of Data Collection:	7/31/2017	
Feature Type:	Sanitary	
Utility Diameter:	8"	
Installation Method:	Open Cut	
Survey Company:	Prein&Newhof	
Data Collection Method:	Conventional Survey	
Equivalent SUE Quality Level:	A	
Observations:	4	
Total Linear Feet Surveyed:	297	



Data Collection #6		City of Howell, Livingston County
Location:	I-96 Business (Grand River Avenue) & Barnard Street	
Utility Company Name:	ACD Telecom, Inc.	
MDOT Permit Number (if applicable):	46871	
Date of Data Collection:	8/8/2017	
Feature Type:	Communications	
Utility Diameter:	1"	
Installation Method:	Horizontal Directional Drill	
Survey Company:	OHM Advisors	
Data Collection Method:	Conventional Survey	
Equivalent SUE Quality Level:	A (intermediate shots were at hand holes)	
Observations:	8	
Total Linear Feet Surveyed:	389	





Data Collection #7		Georgetown Township, Ottawa County
Location:	M-121 (Chicago Drive)	
Utility Company Name:	Georgetown Township	
MDOT Permit Number (if applicable):	43583	
Date of Data Collection:	8/15/2017	
Feature Type:	Sanitary, Communications, Water	
Utility Diameter:	36" (Sanitary), 1" (Communications), 4" & 8" (Water)	
Installation Method:	Open Cut (Sanitary), Discovered (Communications, Water)	
Survey Company:	Prein&Newhof	
Data Collection Method:	Conventional Survey	
Equivalent SUE Quality Level:	A	
Observations:	14	
Total Linear Feet Surveyed:	486	



Data Collection #8		White Lake Township, Oakland County	
Location:	M-59 (Highland Road)		
Utility Company Name:	White Lake Township		
MDOT Permit Number (if applicable):	32587		
Date of Data Collection:	8/22/2017		
Feature Type:	Water		
Utility Diameter:	10"		
Installation Method:	Horizontal Directional Drilling		
Survey Company:	Johnson & Anderson, Inc.		
Data Collection Method:	Conventional Survey		
Equivalent SUE Quality Level:	A (start and end points), B (intermediate points)		
Observations:	14		
Total Linear Feet Surveyed:	226		





Data Collection #9		Georgetown Township, Ottawa County
Location:	M-121 (Chicago Drive)	
Utility Company Name:	Georgetown Township	
MDOT Permit Number (if applicable):	43583	
Date of Data Collection:	8/29/2017	
Feature Type:	Sanitary, Gas	
Utility Diameter:	36" (Sanitary), 4" (Gas)	
Installation Method:	Open Cut (Sanitary), Discovered (Gas)	
Survey Company:	Prein&Newhof	
Data Collection Method:	Conventional Survey	
Equivalent SUE Quality Level:	A	
Observations:	4	
Total Linear Feet Surveyed:	102	

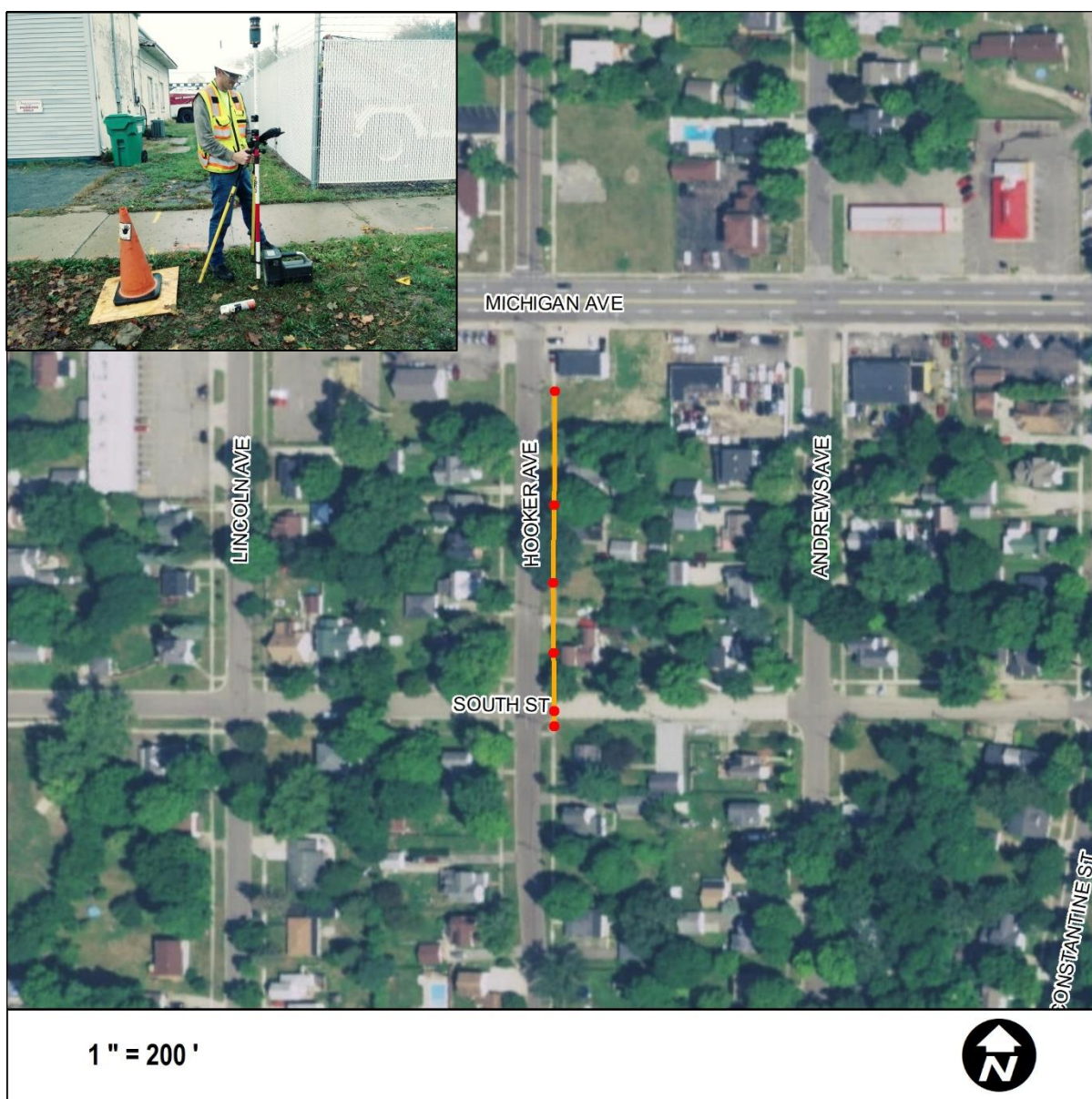


Data Collection #10		Crockery Township, Ottawa County	
Location:	M-104 (Cleveland Street)		
Utility Company Name:	Charter Communications		
MDOT Permit Number (if applicable):	49093		
Date of Data Collection:	8/29/2017		
Feature Type:	Communications, Gas		
Utility Diameter:	1" (Communications), 1" (Gas)		
Installation Method:	Horizontal Directional Drill (Communications), Discovered (Gas)		
Survey Company:	Prein&Newhof		
Data Collection Method:	Conventional Survey		
Equivalent SUE Quality Level:	A (start & end points of communications, gas), B (intermediate points of communications)		
Observations:	16		
Total Linear Feet Surveyed:	2,132		





Data Collection #11		City of Three Rivers, St. Joseph County	
Location:	Hooker Avenue		
Utility Company Name:	D&P Communications		
MDOT Permit Number (if applicable):	49338		
Date of Data Collection:	10/6/2017		
Feature Type:	Communications		
Utility Diameter:	1"		
Installation Method:	Boring		
Survey Company:	Prein&Newhof		
Data Collection Method:	Conventional Survey		
Equivalent SUE Quality Level:	A (start & end points), B (intermediate points)		
Observations:	6		
Total Linear Feet Surveyed:	382		

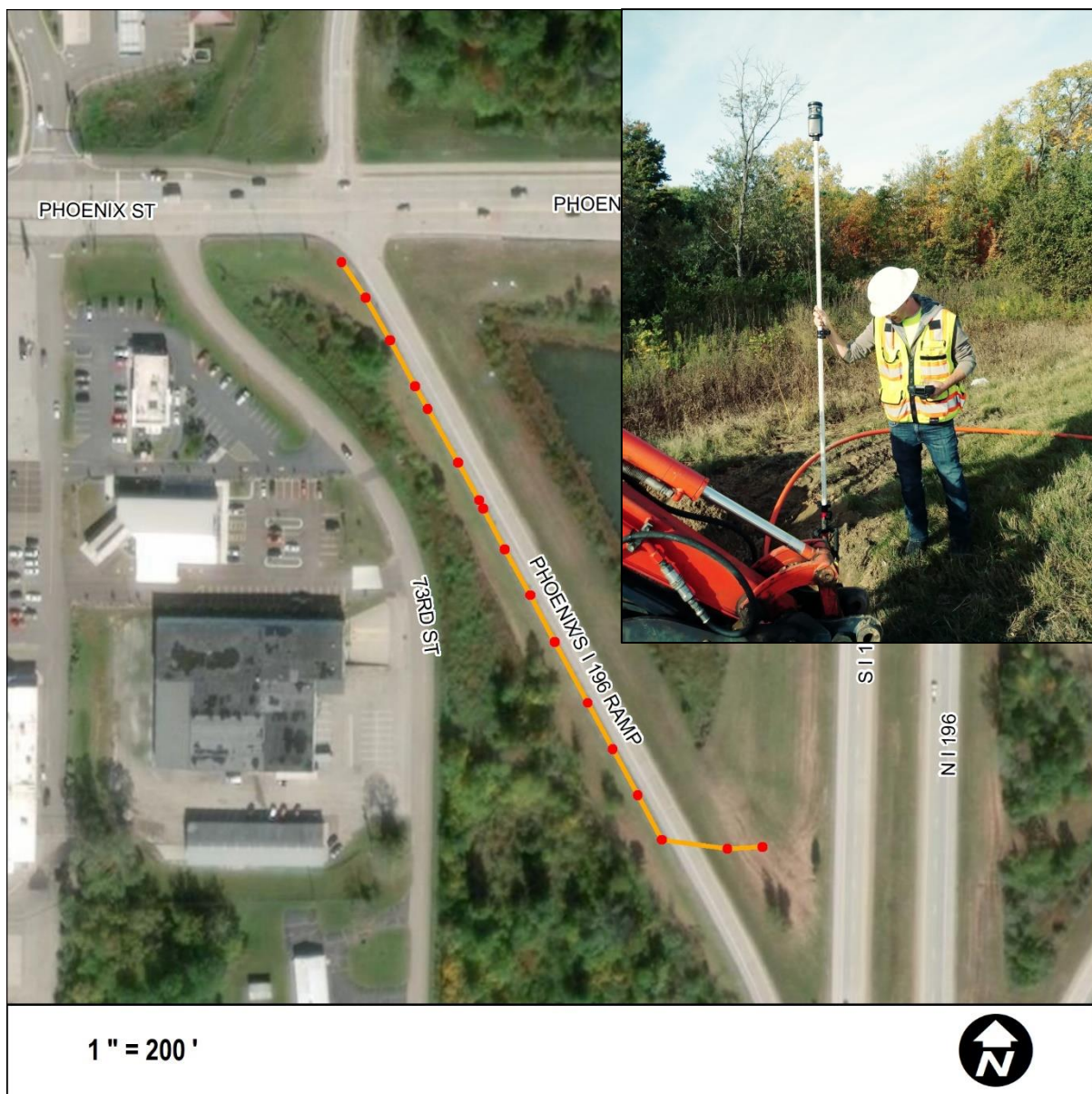


<b>Data Collection #12</b>	<b>Allendale Township, Ottawa County</b>
<b>Location:</b>	M-45 (Lake Michigan Drive)
<b>Utility Company Name:</b>	Charter Communications
<b>MDOT Permit Number (if applicable):</b>	49100
<b>Date of Data Collection:</b>	10/9/2017
<b>Feature Type:</b>	Communications
<b>Utility Diameter:</b>	1"
<b>Installation Method:</b>	Boring
<b>Survey Company:</b>	Prein&Newhof
<b>Data Collection Method:</b>	Conventional Survey
<b>Equivalent SUE Quality Level:</b>	A (start & end points), B (intermediate points)
<b>Observations:</b>	11
<b>Total Linear Feet Surveyed:</b>	447





Data Collection #13	City of South Haven, Ottawa County
Location:	I-196 (Phoenix Street On Ramp)
Utility Company Name:	123.NET, Inc.
MDOT Permit Number (if applicable):	49270
Date of Data Collection:	10/19/2017
Feature Type:	Communications
Utility Diameter:	1"
Installation Method:	Horizontal Directional Drill
Survey Company:	Prein&Newhof
Data Collection Method:	Conventional Survey
Equivalent SUE Quality Level:	A (start & end points), B (intermediate points)
Observations:	17
Total Linear Feet Surveyed:	872



Data Collection #14	Lake Township, Missaukee County
Location:	I-196 (Phoenix Street On Ramp)
Utility Company Name:	Peninsula Fiber Network, LLC
MDOT Permit Number (if applicable):	50459
Date of Data Collection:	12/6/2017
Feature Type:	Communications
Utility Diameter:	1"
Installation Method:	Boring
Survey Company:	Prein&Newhof
Data Collection Method:	Conventional Survey
Equivalent SUE Quality Level:	A (start & end points), B (intermediate points)
Observations:	13
Total Linear Feet Surveyed:	636





<b>Data Collection #15</b>	<b>City of Cadillac, Wexford County</b>
<b>Location:</b>	Cass Street
<b>Utility Company Name:</b>	City of Cadillac
<b>MDOT Permit Number (if applicable):</b>	N/A
<b>Date of Data Collection:</b>	7/13/2018
<b>Feature Type:</b>	Water
<b>Utility Diameter:</b>	6"
<b>Installation Method:</b>	Open Cut
<b>Survey Company:</b>	Prein&Newhof
<b>Data Collection Method:</b>	Conventional Survey
<b>Equivalent SUE Quality Level:</b>	A
<b>Observations:</b>	4
<b>Total Linear Feet Surveyed:</b>	282

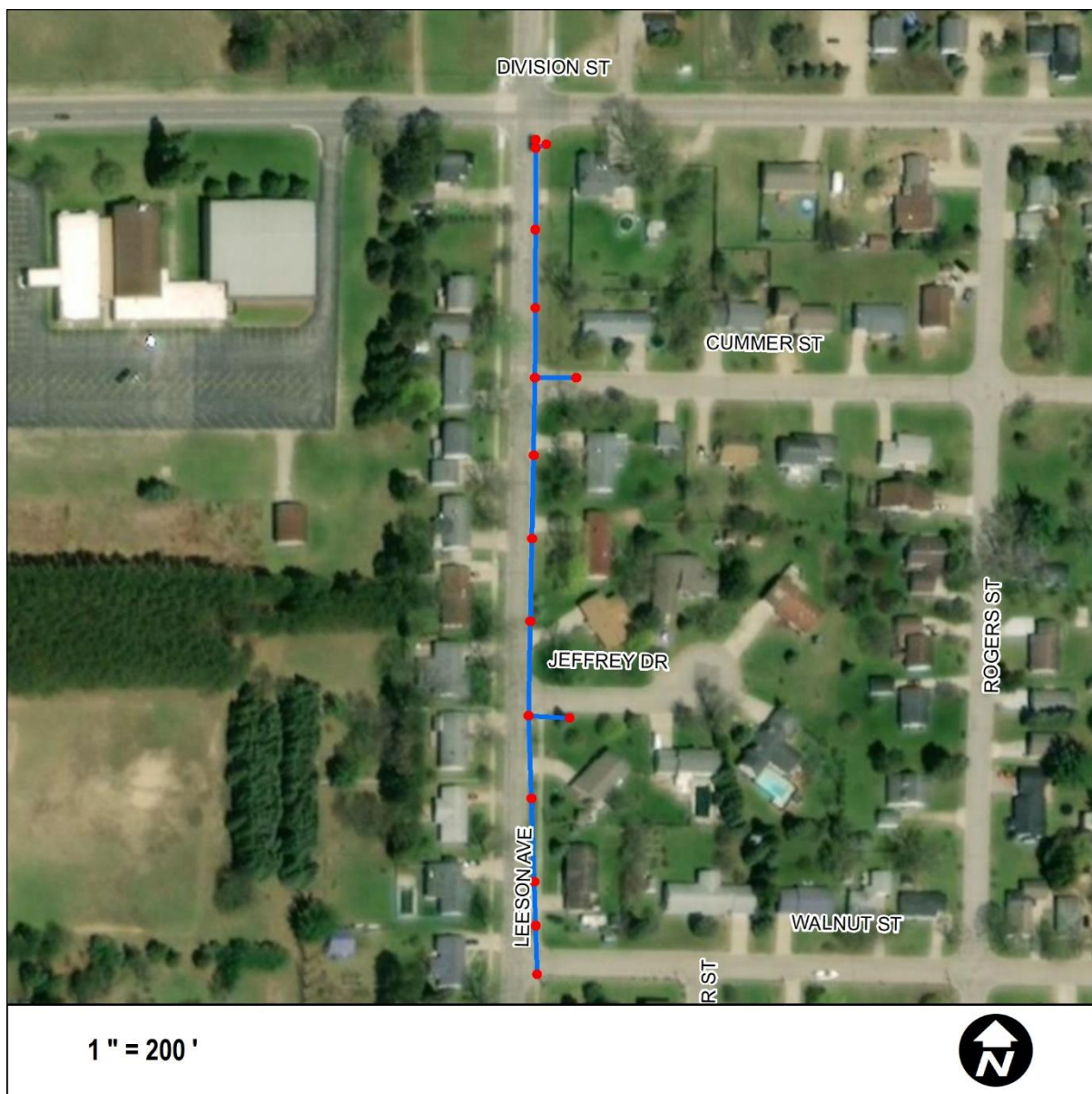


<b>Data Collection #16</b>	<b>City of Ionia, Ionia County</b>
<b>Location:</b>	Chapman Street
<b>Utility Company Name:</b>	Consumers Energy
<b>MDOT Permit Number (if applicable):</b>	14680
<b>Date of Data Collection:</b>	8/14/2018
<b>Feature Type:</b>	Gas
<b>Utility Diameter:</b>	2"
<b>Installation Method:</b>	Open Cut
<b>Survey Company:</b>	Prein&Newhof
<b>Data Collection Method:</b>	Conventional Survey
<b>Equivalent SUE Quality Level:</b>	A
<b>Observations:</b>	44
<b>Total Linear Feet Surveyed:</b>	451





<b>Data Collection #17</b>	<b>City of Cadillac, Wexford County</b>
<b>Location:</b>	Leeson Avenue
<b>Utility Company Name:</b>	City of Cadillac
<b>MDOT Permit Number (if applicable):</b>	N/A
<b>Date of Data Collection:</b>	8/17/2018
<b>Feature Type:</b>	Water
<b>Utility Diameter:</b>	8"
<b>Installation Method:</b>	Open Cut
<b>Survey Company:</b>	Prein&Newhof
<b>Data Collection Method:</b>	Conventional Survey
<b>Equivalent SUE Quality Level:</b>	A
<b>Observations:</b>	24
<b>Total Linear Feet Surveyed:</b>	1,061



## 7 BETA TESTER FEEDBACK

One of the main objectives of the Proof of Program was to evaluate the Manual and the effectiveness of the GUIDE software applications including the Collector for ArcGIS Application and the MDOT GUIDE Web Portal. In order to summarize and effectively gather input from beta testers, P&N designed an electronic survey distributed through surveymonkey.com. Upon completing data collection, the follow-up survey was sent to the participating surveyors to gain feedback opinion on a number of topics organized into four categories; the GUIDE Procedural Manual, the Collector for ArcGIS Application, the conventional survey method, and the MDOT GUIDE Web Portal. The complete survey can be found in [Appendix B](#).

The main findings of the survey include the following:

- Three beta testers completed the survey.
- Two of three found the Manual easy to follow and felt it contained the appropriate level of detail.
- 100% fully understood the technical specifications of GUIDE based on the information provided by the Manual.
- Two of three used the Manual often while in the field.
- All beta testers collected both direct and indirect survey observations.
- One the beta testers used conventional survey methods, the remaining two employed both the Collector for ArcGIS Application and conventional survey.

Overall, respondents to the survey and those interviewed offline found the Manual to thoroughly explain the technical specifications of the GUIDE data as well as the specifics of direct and indirect survey techniques.

## 8 LESSONS LEARNED

In the third phase of GUIDE, the Proof of Program, P&N was able to thoroughly test and evaluate the program. Through data collection and uploading of data at multiple utility installations, P&N was able to identify issues, make recommendations for changes, and prove the validity of the Manual.

- 10 of the 17 data collections completed were MDOT permit work with additional local work completed to continuing testing of the GUIDE processes. Having multiple surveyors with varying years of experience performing this work allowed P&N to prove that the GUIDE Procedural Manual only needed minor tweaking and improvements. P&N surveyors were able to understand the manual, collect and upload data, and feel comfortable that they were correctly performing the work necessary to create an accurate database.
- Some bugs in the program were identified and fixed and several enhancements that were recommended were incorporated. The remaining requested enhancements should be considered in the future can remain on a list to implement at a later date when resources allow.
- Staff from P&N and several beta testers encountered difficulties with the .CSV file upload capability of the MDOT GUIDE Web Portal. A minor typographical error or extra space in a .CSV file, for example, lead to errors in the upload process. Custom functionality could be developed to better handle the errors from the .CSV upload, but since the vast majority of survey software packages on the market today can create an Esri Shapefile, it was determined the Shapefile upload method will now serve as the primary method for MDOT GUIDE Web Portal.
- The GUIDE Proof of Program was set up to have MDOT TSCs forward permits to P&N who would then distribute permits internally or to beta testers. One of the largest challenges of this endeavor was the coordination of the utility installation with data collection.
- Education will be necessary for the surveyors collecting the field data to insure accuracy and consistency.

## 9 RECOMMENDATIONS

### 9.1 Address Remaining Improvements in the MDOT GUIDE Web Portal

The efforts of the GUIDE Team in 2018 focused primarily on identifying and addressing a list of bugs and enhancements. Staff from P&N and Spicer Group compiled a list of bugs and requested enhancements based on their experience during the use of the Collector for ArcGIS Application and the MDOT GUIDE Web Portal.

MDOT combined the P&N and Spicer Group bug and enhancements lists into one. This list was reviewed with MDOT's GIS personnel and staff from the Michigan Department of Technology, Management and Budget (DTMB) Center for Shared Solutions. MDOT GIS personnel along with the Center for Shared Solutions categorized the bugs and enhancements based on feasibility and available resources. The list was divided into the following categories; necessary/simple bug fixes and enhancements, enhancements that can be added with moderate time involved, enhancements requiring a larger amount of time, and enhancements not feasible at the current time. Monthly conference calls with P&N, MDOT, DTMB and Spicer Group were held to discuss the list and track progress on individual issues.

A number of enhancement requests were deemed outside of the current capabilities of ArcGIS Online. In those cases, little can be done aside from keeping informed of Esri's upcoming releases and new improvements. For some of the bug fixes/enhancements that can be addressed but require more resources, greater GIS support will be needed in the future whether provided by MDOT or a consultant.

As of the Fall of 2018, MDOT addressed all of the bugs/enhancements (Item Numbers 1-5) under the necessary/simple bug fixes and enhancements category. Item number 6 in that category is no longer applicable as the .CSV upload of survey data will not be supported moving forward. Table 7, an excerpt of the bug and enhancement list, summarizes the necessary/simple bug fixes and enhancements. The entire bug and enhancement list can be found in [Appendix E](#).



necessary/simple bug fixes and enhancements			
Item Number	Bug or Enhancement	Description	Who Can Fix
1	Bug Collector	<p>Collector for ArcGIS app Sync error on all operating systems</p> <p>The offline sync does not work as documented in conference calls and P&amp;N monthly status reports.</p> <p>We first tested the offline sync mode and found that it is not working properly. All indications on the tablet showed that our data had been synced. However, after logging into the online web portal we were not able to see the pins that I had uploaded. Somehow these are not actually uploading to the server even when collector for ArcGIS indicates that they have. Collector for ArcGIS however never switches back to the live map. The map remains as if it is still waiting to sync the changes.</p>	MDOT & possibly DTMB
2	Bug Web Portal	<p>Download data widget error in the web portal</p> <p>The download functionality at present does not work. Requests are issued and the status wheel spins without any feedback or conclusion.</p> <p>Downloading data from the website also does not work. We believe this is being worked on and should be a top priority.</p>	DTMB
3	Enhancement Web Portal	Adding a step-by-step prompt for the upload process	MDOT
4	Enhancement Web Portal	Data enhancement: In the "Company Collected By" field, it would be ideal to have a domain. We saw inconsistencies even among our own staff (i.e. P&N, Prein and Newhof, Prein&Newhof).	MDOT
5	Bug Web Portal	On the "Download GUIDE Data" tool, there is a field labeled Spatial Reference*. This field is a text box with "Same as Input" entered by default. This should be a pulldown giving the user to select the spatial reference frame OR preferably this is removed and replaced with a note that states the data is being downloaded using the same spatial reference frame as it is stored on the MDOT server which is Michigan State Plane Coordinate System (NAD'83(2011)), xxxxx Zone, with elevations on NAVD'88 datum, and all units are international feet. The intent of this field is to give the user the option to select a different reference frame. This may be useful if they are downloading data that crosses state plane zones. Maybe the data is in Michigan Central, but my project is in Michigan South, so I want to download the data in Michigan South. Seems easiest to remove the field and replace with a note. Low priority.	DTMB/MDOT
6	Bug Web Portal	Along with increased error reporting it <b>may be beneficial to included common formatting issues in the manual</b> so that users know what to look for when receiving a specific error. Such as a simple tip to check for spaces in the data that may be invisible at first glance in their csv file.	Prein&Newhof and/or Spicer Group

Table 7 - Necessary/simple bug fixes and enhancements from Bug & Enhancement List

Several remaining enhancements, Item Numbers 7, 9 and 11, should be considered before opening the MDOT GUIDE Web Portal to more users. Item Numbers 7 and 11 are related and have to do with the overall speed of the Web Portal. Details of each enhancement are shown here in Table 8.

enhancements that can be added with moderate time involved			
Item Number	Bug or Enhancement	Description	Who Can Fix
7	Enhancement Web Portal	Adding a progress and status bar in the upload process  Improve the overall speed for csv/shapefile uploads, or if there is nothing that can be done, provide more feedback during geoprocessing (i.e. "Now processing step 1 of 5..." or a progress bar).	DTMB
not feasible at this time			
Item Number	Bug or Enhancement	Description	Who Can Fix
11	Enhancement Web Portal	Overall speed improvements.  One of the concerns we have is the current performance of the Web Portal site. It's concerning that there is very little data in the database and performance is so poor. It seems like performance will only continue to decline as more data and more users are hitting the site. Lower priority on this fix at this time, but will ultimately need addressed.	

Table 8 - Item Numbers 7 & 11 from Bug & Enhancement List

Performance plays a major role in the success of any online venture<sup>1</sup>. While the MDOT GUIDE Web Portal is not an online venture in terms generating income or selling a product, it will be serving a user base in the future who expects an efficient data upload process. As more and more users are added to the system, performance should be optimized to prevent possible user frustration caused by long wait times. If some of the speed issues are out of the control of the development team, steps should be taken to inform users of the progress of their upload activities as detailed in Item Number 7. Implementing feedback that informs a user that their upload has progressed, either through a number of steps or a percentage of the total time, will prevent them from reloading the site or closing it altogether.

Since Esri Shapefiles will be the only accepted upload data format in the future, serious consideration should be given to addressing Item Number 9, shown in Table 9. Item Number 9 pertains to an issue in the Web Portal "Preview Mode" where uploaded features appear

<sup>1</sup> "Why Performance Matters", Google Web Fundamentals, <https://developers.google.com/web/fundamentals/performance/why-performance-matters/>

generalized and not in their exact location horizontally. As P&N later learned from research by MDOT, the features are uploaded correctly to the final database and this issue is purely a function of the “Preview Mode”. While the final data is not affected, the manner in which features are displayed may lead to confusion for some users causing them to incorrectly alter their data.

involves research and potentially larger amount of time			
Item Number	Bug or Enhancement	Description	Who Can Fix
9	Bug Web Portal	<p>If possible, correct the issue with features not showing their true shape/length when uploaded. According to past discussions, features are successfully stored in the database but do not display correctly in the ArcGIS Online map.</p> <p>Uploading a shapefile seems to need some more programming help in our opinion. Every time you upload a shapefile it will give you the preview of the file. The software will place the preview in the wrong location (within 5 feet) and it will be generalized giving it a low detail appearance. We believe the software is just taking the first and last point and creating a line between them to show you the general location of your data for a preview. This is not the issue, although users would prefer to see the entire geometry during preview. The main issue is after you execute your shapefile upload the geometry remains the same as the preview and we believe it is also storing this geometry like this in the database which is not correct. The CSV upload preview and final view of the data looks perfect so this leads us to believe that even after the data is in the database regardless of CSV or shapefile upload it should be displaying the same way. This should be a high priority fix.</p>	DTMB

Table 9 - Item Number 9 from Bug & Enhancement List

Successfully addressing these three items will position the MDOT GUIDE Web Portal for success as a broader audience begins to use the technology in the future.

## 9.2 Proposed GUIDE Quick Reference Sheet

The following is a quote received from an OHM Advisors beta tester in response to the follow-up survey question “Do you have any suggestions for improving the (GUIDE Procedural) manual?”:

*“There was a surplus of details that forced us to sort through and determine what was important. A leaner manual specifically aimed towards field work would be beneficial.”*

This response was echoed by several surveyors from P&N, so the idea was proposed to develop a reference sheet that could summarize the main technical requirements expressed in the manual. Such a reference would benefit surveyors in the future who might be collecting GUIDE data in the field without the having attended GUIDE training or having the time to read the entire Procedural Manual. The reference sheet would focus on observation standards, the specifics of direct and indirect surveys, utility types and requirements, and datum specifications. In 2018, P&N drafted the Quick Reference Sheet shown in Figures 4 and 5.


The Quick Reference Sheet has not been reviewed or approved by either MDOT or the Survey community as of the publication of this report. Consideration should be given for including a reference resource in the future based upon user feedback.

Figure 4 – Proposed DRAFT GUIDE Quick Reference Sheet (Front)

## DATA COLLECTION

### What You Need to Know

#### Direct Survey Observation



Direct survey observations are to be collected if utilities are installed via open excavation methods or at bore pits and tie in locations where trenchless technologies are used.

Direct survey observations are required where utilities are exposed.


**DO NOT:**

- Shoot MISS DIG Flag Locations
- Shoot service lines less than 2" in diameter.

**DO:**

- Take two observations as far apart as possible if you discover utilities in potholed locations

#### Indirect Survey Observation



Indirect survey observations are to be collected for utilities installed using trenchless technologies.

When crossing pavement, if there are no safe methods of field witnessing the boring location and depth within a pavement section... collect survey observations at the edges of pavement.

If traffic conditions allow, when crossing a pavement section, collect survey observations at a minimum of 25' intervals.

**For Both:**

Alignment and depths must be physically documented at:

- Start/End Points and at a minimum of 100'
- Changes in direction or alignment (vertical or horizontal)
- Change in size, material, number or pair, encasement, etc.

Collect more survey observations along a utility line for better three-dimensional alignment of the utility's representation.

Figure 5: Proposed DRAFT GUIDE Quick Reference Sheet (Back)

#### Datum

- Horizontal:** North American Datum of 1983, 2011 Adjustment (NAD 83) and the Geodetic Reference System of 1980, (GRS80).
- Vertical:** North American Vertical Datum of 1988, (NAVD 88). Use of RTK GPS is acceptable

#### Coordinate Systems

- Michigan State Plane Coordinate System (North, Central, South)
- Unit: International feet (1 foot = 0.3048m)

#### Accuracy

- 0.16' (5cm) - Horizontal and Vertical

Utility Type	Feature Code	Size Parameter
Brine	BRNE	2" or larger
Chilled Water	CHW	2" or larger
Communication	COMM	Fiber optic or copper cables 25 pair or greater
Gas	GAS	2" or larger
Electric	ELEC	Secondary or higher voltage
Pipe	PIPE	2" or larger
Propane	PROP	2" or larger
Sanitary Sewer	SANI	4" or larger
Steam	STEAM	2" or larger
Storm Sewer	STRM	6" or larger
Water	WATR	2" or larger
Other	OTHR	Use professional judgement to determine appropriate size parameter, using a risk-based analysis.

QUICK REFERENCE

### 9.3 Proposed Updates to the Draft GUIDE Procedural Manual

Throughout the data collection efforts of 2017 and 2018, P&N surveyors and field technicians were required to review the GUIDE Procedural Manual prior to beginning a field survey. GUIDE project team staff from P&N compiled comments and suggestions from the surveyors. In early 2019, P&N submitted proposed updates to the GUIDE Procedural Manual to MDOT staff for incorporation into the final document. The proposed updates included the following:

- Removal of all sections pertaining to the Collector for ArcGIS Application and .CSV file upload as those technologies will no longer be used.
- Standardization of terms such as “shapefile” and “Esri” throughout the document.
- Use of shorter external hyperlinks for the benefit of those using the print version of the document. Some hyperlinks were not fully spelled out and others were very long making them difficult to access for those reading the printed version.
- A handful of grammatical and syntactical corrections.

Aside from those improvements the manual provided a thorough and clear understanding of the topics covered including survey observation methods, required datums and coordinate systems, GUIDE utility requirements, and accuracy standards. The manual’s graphics were particularly effective in describing transverse utility crossings and subsequent survey requirements for such installations.

Sections of the manual pertaining to the MDOT GUIDE Web portal were clear to even first time users. The steps detailing the data upload process are well articulated. Overall, the manual was met with approval from all users. Moving forward, the manual will need to evolve as any future changes to the Web Portal are made.

## 10 PROOF OF PROGRAM SUMMARY

The GUIDE Proof of Program began in Spring 2017 and concluded in early 2019. The goals of this phase included the coordination of construction permits with survey data collection, the validation and review of the Manual, and the thorough testing of GUIDE software applications including the Collector for ArcGIS Application and the MDOT GUIDE Web Portal. Each of these goals was accomplished with varying degrees of success. Permit activities, for example, proved to be a challenge to correctly time for the efficient collection of survey field data.

The review of the Manual proved that the content within successfully covered the technical aspects of field data collection and instructed users on the specifics of the GUIDE software applications. Proposed changes to the Manual will need to reflect the decision to no longer use the Collector for ArcGIS Application.

Through the upload of 8,587 linear feet of surveyed utilities, the MDOT GUIDE Web Portal has been thoroughly tested. The MDOT GIS team successfully addressed a number of bugs and enhancement requests, though several enhancements outlined in this report should be strongly considered for future implementation as GUIDE is fully implemented and welcomes a larger user base.

## APPENDICES

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## Appendix A

### Beta Testing & Early Adopter Program Documents

## Solicitation of Interest

### Volunteers Needed for GUIDE Beta Testing Early Adopter Program

The Michigan Department of Transportation (MDOT) is soliciting interest for participants needed to test the Department's Geospatial Underground Infrastructure Data Exchange (GUIDE) data collection standards and process during the 2017 construction season.

#### **GENERAL INFORMATION and BACKGROUND:**

Beginning in 2013, the Michigan Department of Transportation (MDOT), in partnership with the Michigan Utility Coordination Committee (MUCC), collaborated on a pilot initiative titled Geospatial Utility Infrastructure Data Exchange (GUIDE). During the 2013 calendar year, the MUCC developed a Draft Requirements Document for use in its 2014 pilot field study involving three of the state's largest utilities: AT&T, Consumers Energy and DTE Energy. See [2014 GUIDE Pilot Initiative Report](#) for additional information.

Starting in late 2015 and continuing throughout 2016 MDOT developed a comprehensive set of collection standards, data schema, data dictionary, template geodatabase, field web collection application and field guidance information to continue GUIDE's advancement. This information was completed in January 2017 and is currently being integrated into MDOT's ArcGIS On-Line environment for future field implementation. See [Draft MDOT GUIDE Procedural Manual](#) for additional information.

Obtaining accurate utility information is essential for transportation infrastructure projects. Collecting and maintaining geospatial data needs to be standard practice for all permitted underground utilities located within the public right-of-way. GUIDE presents an enterprise focused solution for meeting the challenges of collecting, maintaining and using accurate utility information. This proof of program phase is a vital component to GUIDE's successful advancement and future statewide implementation.

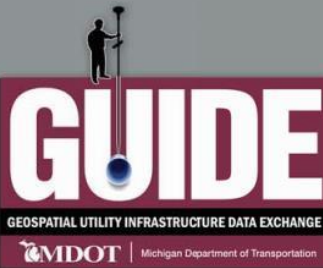
#### **GUIDE Beta Testing & Early Adopter Program**

To validate the comprehensive set of collection standards, data schema, data dictionary, template geodatabase, field web collection application and field guidance information MDOT is seeking volunteer consultant firms to participate in field validation during the summer of 2017.

Interested parties will be invited to participate in a 2-3 hour training session in Lansing, Michigan sometime in early May of 2017. Attendees will be provided with certificates of Continuing Education Hours for the training. Upon completion attendees will be placed on a list for MDOT to pair with future permit(s) involving installation of underground utilities in MDOT's Right of Way. Based on geographic proximity the participants will be contacted to provide 3 hours of in-kind field data collection on the utility installation and provide GUIDE data to MDOT or its Consultant upon completion. MDOT will coordinate field activities with the permit installations. A follow up interview or survey will be conducted by MDOT or its Consultant to gather feedback on the use of the GUIDE standards and field collection application. MDOT will not provide compensation to volunteer participants as part of this program.

#### **Response**

Interested participants must indicate their interest by TBD date by sending an e-mail to Nick Lefke at [lefken@michigan.gov](mailto:lefken@michigan.gov)



## EARN 3.0 CEH GUIDE Phase III Data Collection Process Training

**Tuesday, May 23rd, 2017  
9:00a.m.-12:00p.m.**

**Michigan Department of Transportation  
Office of Aeronautics  
2700 Port Lansing Road  
Lansing, MI 48906-2160**

The Michigan Department of Transportation (MDOT) is undertaking phase III of its Geospatial Utility Infrastructure Data Exchange (GUIDE) initiative. Phase III involves field data collection and process validation of the January 2017 draft GUIDE Procedural Manual. The procedural manual defines the attributes and spatial accuracy in which permitted underground utility installations need to be collected, recorded and submitted for approval and storage. Industry representatives will participate in hands on training, walking them through the complete data collection process using Collector for ArcGIS and established surveying procedures.

Participants should come prepared with the following:

1. Laptop computer
2. Tablet device running Collector for ArcGIS  
(Android, iOS, or Windows10 only)

One set of user credentials will be provided for each participating organization. Credentials will allow each organization to connect to MDOT's spatial database engine through Collector for ArcGIS and the GUIDE web portal in order to contribute data to the proof of program phase.

### **Presented by:**

**Nick Lefke - Utility Coordination Specialist - MDOT**

Mr. Lefke has statewide responsibilities overseeing the department's entire utility coordination program. He has been the GUIDE Project Manager since conception.

**Eric Barden, PS – Spicer Group, Inc.**

Mr. Barden is the principal in charge of Spicer Group's geospatial services group, and has been assisting MDOT in the development of the GUIDE standards and procedural manual.



**Geospatial Utility Infrastructure Data Exchange (GUIDE) Industry Training  
MDOT Aeronautics Auditorium – May 23, 2017**

**AGENDA**

- I. 9:00 am: Welcome and Introductions
- II. 9:10 am: GUIDE Background
- III. 9:30 am: GUIDE 2017 - Proof of program, data collection and process validation
- IV. 9:35 am: GUIDE Web Portal
  - a. General Navigation
- V. 9:50 am: Collector for ArcGIS
  - a. Signing on and general navigation
- VI. 10:00 am: Break
- VII. 10:10 am: GUIDE Attribution
  - a. Understanding the database schema
  - b. Explanation of Attributes and Domain Values
- VIII. 10:40 am: Data Collection Process
  - a. Collector for ArcGIS
    - i. Collecting data in the field using Collector for ArcGIS for data attribution
    - ii. Validating and editing data collected using Collector for ArcGIS
  - b. Survey data preparation
    - i. Preparing field collected survey data for upload to MDOT's servers
  - c. GUIDE Web Portal
    - i. Uploading data to the GUIDE web portal
    - ii. Downloading data from the GUIDE web portal
- IX. 11:40 am: Closing
  - a. Next steps
    - i. Coordination with Prein&Newhof
    - ii. MDOT permit – data collection and process validation
      - 1. Provide process feedback

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## MDOT GUIDE Meeting Minutes

**GUIDE Training - 5/23/2017 9:00 a.m. – 12:00 p.m.**

**P&N Team, Spicer, MDOT, Beta Testers, Utah DOT, Consumers, and DTE**

### **Phase III Proof of Program/Process Validation**

- Background of Project
  - Phase I: AT&T, Consumers, DTE
  - Phase II: Procedural Manual
  - Phase III: Data collection and process validation
  - \$345,000 invested thus far
- Explanation of P&N's role, as well as Spicer's and Beta Testers
- Coordination w/ MDOT TSCs

### **Training was hands on**

- Field collection information
- How to input data entry; step by step
- Suggest Revisions; give feedback and comments
- Document "Proof of Program" final deliverable
- MDOT permits will be handed out based on survey team's location
- Timing of Permits may be difficult based on utility's schedule
- Surveying of local utility is fine. Does not have to be MDOT permits
- Data will be wiped out after this phase
- Pilot document
- ASCE utility as-built standard
- Beta Testers

Consumers Energy

OHM

DTE Energy

Rowe

F&V

Spalding DeDecker

FTC&H

SSI

Gourdie Fraser

Wade Trim

Johnson&Anderson

Mannik & Smith



## Appendix B

### Beta Tester Survey

**1. Name and Company**

**2. Date**

**3. Type of Data Collection Method**

- ☐ ArcGIS Collector
- ☐ Conventional Surveying Methods
- ☐ Both Methods Utilized

The GUIDE Procedural Manual will be referred to as "the manual".

**4. I found the manual easy to follow.**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**5. The manual contains the appropriate level of detail to facilitate my field work.**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ If disagreeing, please recommend improvements.

**6. I referred to the manual often during data collection in the field.**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**7. I fully understood the technical specifications of the data to be collected in the field (i.e. spatial accuracy standards, naming conventions, required fields, etc.) after reading the manual.**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree


**8. I referred to the manual often while uploading my data to the GUIDE portal.**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree


**9. The manual contains the appropriate level of detail to facilitate the uploading of data to the GUIDE portal.**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ If disagree, please recommend improvements.

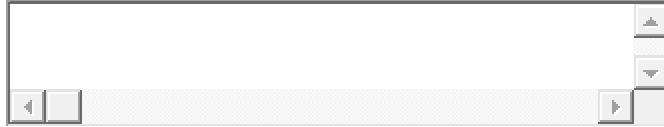
**10. Do you have any suggestions for improving the manual?**

**11. Did you encounter any errors, typos, etc. while using the manual?**

A text input field with a light gray border and a light gray background. It has a small upward arrow icon in the top right corner and a small rightward arrow icon in the bottom right corner.

**12. Are there any other general comments you would like to share about the manual?**

A text input field with a light gray border and a light gray background. It has a small upward arrow icon in the top right corner and a small rightward arrow icon in the bottom right corner.

**Collector for ArcGIS (if you used this method)**

**Please skip questions if they are not applicable**

**13. What type of data connection did you use?**

- ☐ Live cellular connection at the site
- ☐ I downloaded the data prior to going to the site (disconnected editing)

**14. If using a live connection, did you experience any issues? (i.e. poor reception, lost connection, data would not upload)**

- ☐ Yes
- ☐ No

If yes, please comment.

A text input field with a light gray border and a light gray background. It has a small upward arrow icon in the top right corner and a small rightward arrow icon in the bottom right corner.

**15. I found the Collector for ArcGIS App easy to use**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

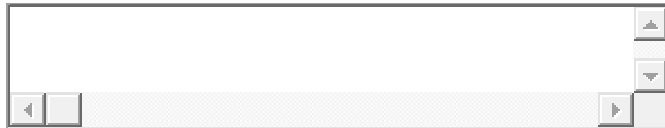
**16. I found the Collector for ArcGIS App data forms to be efficient and well laid out**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**17. I prefer the Collector for ArcGIS method over the conventional survey method**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ I have not used both methods

**18. Do you have any comments/suggestions/improvements to share regarding the Collector for ArcGIS App and you experience with it?**



**Conventional Survey Method**

**19. The manual did a good job explaining the nuances of the conventional survey method**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**20. I prefer the conventional survey method over the Collector for ArcGIS method**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree
- ☐ I have not used both methods



**21. I downloaded the sample shapefile from Michigan.gov web site**

- ☐ Yes
- ☐ No

**22. What software package did you use to create your shapefile for upload to the MDOT portal?**

**23. Did you encounter any issues populating your shapefile?**

**24. I did not encounter any issues logging in to the MDOT portal**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

Comments

**25. The GUIDE manual directions were clear and helpful in regards to the upload process**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

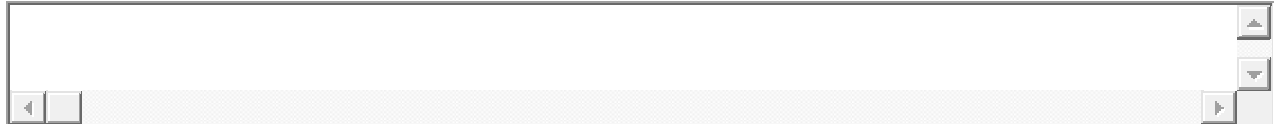
**26. The upload process for my .csv/ shapefile went well**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

**27. I encountered errors during the upload process or my upload failed**

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

Comments



**28. I downloaded existing GUIDE data to explore or use**

- ☐ Yes
- ☐ No

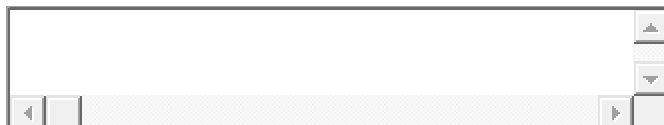
**29. I found it easy to download and use existing data**

- ☐ Yes
- ☐ No

**30. What format did you download your data in?**

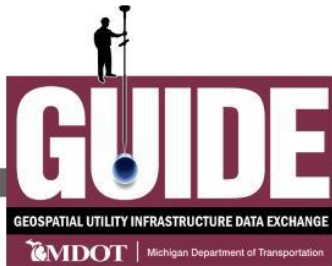


**31. What software package do you use to view downloaded data?**

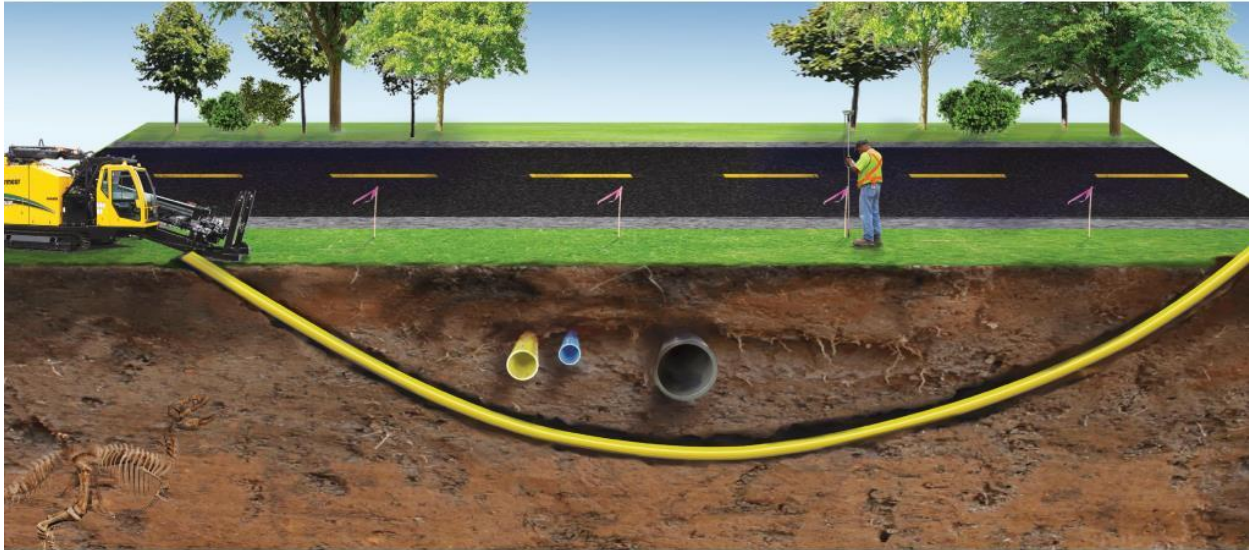


## Appendix C

### Permit Attachment



## SPECIAL CONDITIONS FOR UNDERGROUND UTILITY INSTALLATIONS



This permit has been selected to participate in the Michigan Department of Transportation's (MDOT) Geospatial Utility Infrastructure Data Exchange (GUIDE) proof of program initiative. GUIDE requires that the location of new underground utility installations be surveyed in X, Y and Z at the time of installation. In addition, various defined attributes will be recorded denoting the utility owner, size, type, etc. This data will be formatted and saved to MDOT's spatial database, where the data will be managed in a highly secure environment with controlled access.

### **MDOT Responsibilities:**

- Educate permit applicant on GUIDE and share best practices for coordinating the data collection.
- Data collection will be completed by a MDOT Survey Consultant at no cost to the permit applicant.

### **Permit Applicant Responsibilities:**

- Participate in a pre-construction meeting.
- Fully cooperate and coordinate the installation activities with MDOT and its surveying consultant.
- Participate in a post construction meeting and/or survey.

### **Additional Details:**

The permit applicant's name, permit details, construction photos and GUIDE data may be included in a final report documenting the GUIDE proof of program results.





## Appendix D

### SHRP2 Application

## SHRP2 Implementation Assistance Program

Round 7 Application Form – LEAD ADOPTER INCENTIVE – *Application period closes April 29, 2016.*

**Name of Product: Utility Bundle (R01A/R01B/R15B)**

**FHWA Product Lead Name:** Matthew DeMarco, [Matthew.DeMarco@dot.gov](mailto:Matthew.DeMarco@dot.gov), 720-963-3520

This collection of SHRP2 products is part of Round 7 of the Implementation Assistance Program. For more information about these products or about applying for implementation assistance, visit the [Implementation Assistance Program page](#) or this product bundle's application page on the GoSHRP2 Web site.

### Point of Contact (POC):

The SHRP2 Implementation Assistance Program is designed to foster peer learning, and as a result, applicants are encouraged to share their experience implementing SHRP2 products with others. By submitting this application, your organization grants permission to FHWA to publish and distribute the name and business email address of a **staff member from the applying organization** who is familiar with the implementation project. Please provide:

POC Name: Nick Lefke

POC Business Email Address: [LefkeN@michigan.gov](mailto:LefkeN@michigan.gov)

POC Business Phone Number: (517) 335-2208

### Application Criteria

The following information defines product-specific implementation expectations to be addressed in the application.

**3D Utility Location Data Repository (R01A):** SHRP2's 3D storage and retrieval data model will accommodate large volumes of utility data, interface with existing design software, and provide a method for organizing utility data so it can be used reliably throughout the project design phase, during construction, and on future projects.

Key implementation expectations for [R01A](#) include:

- Develop guidelines and specifications to fully integrate the [3D Utility Location Data Repository](#) into business processes sufficient for use on all future projects.
- Following development and testing of the utility database, demonstrate its use on at least one corridor.
- Coordinate periodically with American Society of Civil Engineers' (ASCE) two committees working on utility standards to provide and receive input on those standards that are currently in development.

- Participation in [R01A](#) product evaluation including a qualitative, organizational, before/after assessment conducted by an independent consultant for FHWA.

**Utility Locating Technologies (R01B):** R01B supports the use of two technologies for the 3D location of utilities: multi-channel ground penetrating radar (MCGPR) and time-domain electromagnetic induction (TDEMI). IAP funding will support a two-step deployment process to (1) pilot one or both of the advanced utility investigation technologies, and then (2) verify utility locations and depths per ASCE Quality Level A standards. Implementation may be conducted by internal staff and/or a subsurface utility engineering (SUE) service provider.

Key implementation expectations for [R01B](#) include:

- Evaluate proposed pilot site conditions to determine suitability for use of the MCGPR and/or TDEMI technologies. For MCGPR, avoid clayey soil locations that will interfere with radar data collection. For TDEMI, avoid locations with surficial metallic objects within 15 ft of the test areas. General information on soil conditions may be acquired at: [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/maps/?cid=nrcs142p2\\_053622](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/maps/?cid=nrcs142p2_053622)
- Run through the SUE process using both normal and advanced utility investigation technologies (advanced utility investigation technologies refers to the enhanced capability to detect and measure x, y, and z data, and characterize this data with appropriate positional accuracy and validation measures).
- Validate the accuracy of the advanced utility investigation technologies (QL-A), and undertake a comparison of different types of geophysics technologies to determine which one(s) perform most effectively.
- Identify how the routine use of these technologies will be integrated into agency utility location practices.

SUE providers are a major stakeholder in locating subsurface utilities. Therefore, R01B applicants are required to reach out to their SUE providers in advance of submitting an application. Please include in your application a description of the coordination efforts with the agency's SUE providers. Include in the application the full breakdown of financial assistance being requested. The cost breakdown should include: the cost of SUE providers to pilot the 1-2 advanced utility locating technologies, cost of evaluating the R01B technologies in comparison to the agency's conventional methods, training, outreach, case studies, etc. As described above, please note that all agencies may not be well-suited for implementing these advanced utility locating technologies due to geophysical limitations. Applicants will be required to describe the pilot project characteristics that make it a successful candidate.

**Identifying and Managing Utility Conflicts (R15B):** R15B provides a Utility Conflict Matrix (UCM) designed to help agencies and utility companies manage conflicts effectively during project development, design, and construction. Use of the UCM-based approach results in identifying utility conflict issues early in design, provides a common platform for communicating utility conflicts between agency and utility company stakeholders, and greatly simplifies utility management processes.

Key implementation expectations for [R15B](#) include:



- Develop and incorporate Excel, MS Access and/or enterprise-based UCM within existing utility management program.
- Update utility business processes and supporting documentation within the agency to accommodate the use of the matrix throughout project design and construction.

**Questions:**

1. Select the Utility Bundle product(s) that will be implemented:
  - ☒ 3D Utility Location Data Repository (R01A)
  - ☐ Utility Locating Technologies (R01B)
  - ☐ Identifying and Managing Utility Conflicts (R15B)
2. Describe your organization's interest and goals in implementing the selected *Utility Bundle* products. What general outcomes do you expect to achieve from implementing these technologies?

The Michigan Department of Transportation (MDOT) is committed to providing the highest quality integrated transportation services for economic benefit and improved quality of life. To achieve this mission we strive to employ progressive, innovative solutions to the problems we face as owners and operators of a large network of transportation infrastructure. Utility conflicts, delays and associated claims have a negative impact on project and program level pursuit of our mission, however with spatial positioning technology, data accessibility and mobile data access we have a goal of unifying stakeholders around accurate known utility information in a digital format.

MDOT is a recognized innovation leader in the area of Civil Integrated Management (C.I.M.) and 3D design. MDOT personnel involved with this initiative have significant, recent and relevant experience with knowledge sharing and promotion of technology related innovations. For example, MDOT's Bureau of Highway Development has taken lead roles in the following initiatives:

Initiative	Role
AASHTO Technology Implementation Group (TIG) for Utility Relocation Electronic Document Management Systems (UREDMS)	1 of 7 lead states promoting use and participating UREDMS applications and involved in knowledge transfer opportunities.
FHWA Every Day Counts (EDC) 2-3D Engineered Models for Construction	Technical web-based training material development. Peer review workshop presentations.
AASHTO/FHWA EDC3 eConstruction	Lead state. Peer review host and workshop presentations.
FHWA Sponsored Webinar - "Managing As-built Utility Location Data to Lessen Conflicts and Delays"	Co – presenter with Phillip Meis, chair of ASCE Utility As-Built Committee.



### **Background**

Obtaining accurate underground utility location information is essential for transportation infrastructure projects. Collecting and maintaining geospatial data needs to be standard practice for all underground utilities located within the public right-of-way. MDOT's Geospatial Utility Infrastructure Data Exchange (GUIDE) initiative presents an enterprise focused solution for meeting these challenges of collecting, maintaining and using accurate underground geospatial utility location information.

In 2013, MDOT, in partnership with the Michigan Utility Coordination Committee (MUCC), collaborated on the GUIDE pilot initiative. During the 2013 calendar year, the MUCC developed a Draft Requirements Document for use in its 2014 pilot field implementation study involving three of the state's largest utilities. These utilities performed multiple planned new facility installations and piloted the work associated with collecting quality geospatial data identifying the precise location of the newly installed underground facility. The geospatial data was then provided to MDOT for inclusion in an enterprise spatial database built in esri's ArcGIS Online (AGO). MDOT also did proof of concept exploration with the workflow, using generic output formats available in esri AGO, from the enterprise spatial database to 3D design.

In 2014, MDOT obtained State Transportation Innovation Council (STIC) funding to document the MUCC's GUIDE pilot initiative. The results were published in the [2014 GUIDE Pilot Initiative Report](#) and the [GUIDE \(Prezi\) Presentation](#). The presentation highlights data collection locations, field photos and sample esri AGO outputs. MDOT assumed the lead role in developing the pilot data collection standards and the spatial data repository in AGO as a proof of concept.

The GUIDE report details MDOT's successful utilization of esri's AGO as a central data repository. MDOT also did proof of concept exploration with the workflow, using generic output formats, available in esri AGO, from the enterprise spatial database to 3D design. Based on the output format flexibility apparent in esri AGO, the integration of 3D data into the design software should not present a significant challenge, regardless of platform and/or vendor. At present, MDOT is a leading agency in 3D roadway design modeling using Bentley Power GEOPAK software.

In 2015, MDOT secured its second round of STIC funding dedicated to further developing, refining and continuing GUIDE advancement. The current ongoing work involves the development of the following:

- Comprehensive set of requirement documents
- Collection standards
- Template data collection files
- Documented data schema for all underground utilities
- Recommended QA/QC steps
- Data collection interface to ArcGIS online

These deliverables will be an invaluable resource in accurately documenting the collection and maintenance of geospatial data for permitted underground utility installations. Furthermore, these deliverables will position MDOT to proceed from pilot to proof of implementation in an [MDOT Region](#) geographical area.

The consultant, assisting MDOT with the 2015 STIC funding, has teamed up with two specialized consultant's, one of which is Cardno. Cardno's involvement and knowledge with ASCE's ongoing efforts for the new *Utility As-Built Data Standard* and the re-write of the *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (38-02)* is providing valuable input, as well as an ASCE perspective, into MDOT's GUIDE documentation development.

### Outcomes

To achieve a sustainable, mature approach to the collection of underground utility data, MDOT is promoting rigid collection standards and a highly accessible, secure spatial data repository.

Current project centered approaches often have a narrow focus in terms of maintaining true enterprise usefulness. MDOT is proposing a long term approach to 3D modeling with continuous collection and seamless dissemination of accurate underground utility data. It is our position that this approach is more sustainable, filling the historic gap of unreliable as-built data storage with modern technology solutions. Building the data collection standards and a highly accessible repository are vital first steps to focus end-user customization activities. This enterprise-level-down focused approach benefits all stakeholders for the life of the asset as opposed to traditional project focused Subsurface Utility Engineering activities, which only benefit the immediate project.

3. Briefly describe your agency's current processes for locating, communicating and managing utilities with both internal and external stakeholders. Identify needed areas of improvement within your overall utilities program.

MDOT's current process for identifying, communicating and managing utilities, centers on our Utility Relocation Tracking System (URTS) application. URTS is a statewide application utilized at MDOT's seven Region offices and 22 Transportation Service Centers (TSC). The URTS application houses utility contact information and general vicinity location for over a 1,000 utilities. This is where MDOT starts and manages all project utility coordination.

Thanks to implementation assistance from SHRP2 R15B, Round 3, MDOT was able to enhance the URTS application with the following key features:

- Added an external application component
- Created user roles for Utility Companies and Design Consultants
- Created a tracking module
- Incorporated a MDOT modified Utility Conflict Matrix
- Improved document management

MDOT communicates with all known utilities early in the design phase engaging them in project coordination. One of the first steps in the project coordination process is for MDOT to solicit facility location information. This information is then plotted on the plans and reviewed for potential conflicts. Preliminary plans are sent to utilities along with a list of known and potential conflicts. Depending on the project's scope of work and/or utility impacts MDOT will typically hold a utility coordination meeting with all



stakeholders. Utility conflicts are continuously coordinated until a resolution has been reached. These steps allow MDOT to include the project's utilities status in the contract documents, informing contractors of the project's utility involvement.

Some areas within MDOT's utility coordination program which could use improvement include:

- Knowing ALL utilities which have facilities within the project limits prior to initiating the coordination process
  - Utilities responding in a timely manner to facility location requests
  - Utilities responding with precise facility location information, specifically underground depth data
  - An updated Utility Coordination Manual for internal and external customers
  - Training
4. If selecting [R01A](#) and/or [R15B](#), provide an overview of your agency's utility data management program, processes and applications, including data storage, retrieval and user access options and design platforms.

MDOT has not formally implemented enterprise-wide data collection, storage, retrieval, or display requirements for utility data. However, the GUIDE pilot initiative is an example of a successful proof of concept we would like to leverage to proof of implementation. The GUIDE report notes MDOT's successful utilization of esri's AGO as a central data repository for underground utility data.

5. If selecting [R01B](#), briefly describe your current utility location procedures and capabilities, including data acquisition methods currently used, in-house vs. SUE provider delivery, etc. Also, describe the suitability of proposed pilot sites for using MCGPR and/or TDEMI (non-clayey soils for MCGPR applications, no metallic objects within 15 feet of TDEMI applications).

N/A

6. Briefly describe your agency's plan for deploying/implementing the selected product(s). Include a general timeline for completing major implementation tasks, how/when the award funds will be obligated, and what types of technical assistance you envision needing to be successful. Describe product demonstrations to be conducted within current projects, preferably early in the planning/design process.

#### Plan

MDOT will hire a consultant to provide implementation assistance supporting R01A. The core deliverables will primarily focus on field implementation of the 2015 STIC funded documents and data collection application on real time field installations within an MDOT Region's geographical area. Field implementation includes piloting, testing and refining the GUIDE process on actual new underground utility installations.

Anticipated tasks the consultant will be required to perform are:

- Knowledge transfer with MDOT Region staff

- Collection of geospatial underground utility data
- Testing comprehensiveness of documentation requirements
  - Modify documentation requirements resulting from field results
- QA/QC verification
- Loading and retrieving data from central data repository (esri's AGO)
- Documentation of results

Obtaining SHRP2 R01A implementation funding would allow MDOT's GUIDE vision to move forward. This funding would represent GUIDE phase III. Phase I (2013 and 2014) was the initial pilot and GUIDE report. Phase II (2015 to current) is the development of comprehensive documentation preparing for future field implementation and proof of program. Phase III would use the lessons learned from Phase I and the documents from Phase II in conducting actual field implementation to test, refine and prove GUIDE's proof of program.

MDOT will continue to coordinate the proposed SHRP2 R01A implementation assistance tasks with the MUCC. MUCC membership consist of the following: Michigan Infrastructure and Transportation Association, construction contractors, American Council of Engineering Companies of Michigan, design consultants, Michigan Municipal League, several of the state's largest utility companies (DTE Energy, Consumers Energy, AT&T and Frontier Communications), Michigan Association of County Drain Commissioners, County Road Association of Michigan, Michigan's One Call System (MISS DIG) and MDOT. The MUCC will serve as an advisory panel for decisions impacting the membership's standard business practices.

#### Timeline

MDOT is proposing the following work schedule:

Major Implementation Tasks	Start	Complete
Project funds obligated	May 2016	September 2016
Develop RFP for consultant services	June 2016	August 2016
Procurement process	September 2016	December 2016
Utility field data collections and process flow validations	January 2017	December 2017
Final report	November 2017	April 2018

#### Technical Assistance

Beyond funding, MDOT is not anticipating the need for any technical assistance. However, MDOT will advise the SHRP2 Program Administrator if any challenges arise where technical assistance may be needed.



7. Briefly describe demonstrated executive-level support for adopting new utility management practices and developing the tools and capabilities associated with the selected [Utility Bundle](#) products.

Executive-level support has been routinely demonstrated by MDOT's Director. Since pilot conception, MDOT's Director has endorsed the GUIDE initiative several times while giving Department innovation PowerPoint presentations. MDOT's Director supports and encourages GUIDE's continued advancement and fully supports the technical work included, moving GUIDE from proof of implementation to proof of program.

The Director supports GUIDE as an enterprise-wide approach to mature use of lifecycle data and treats utility 3D data as an asset. He understands that GUIDE collects highly accurate underground utility data, at the most opportune time in our infrastructure life-cycle, typically at the time of utility installation. Underground utility data collection at the time of installation shows a level of commitment to obtaining accurate underground utility data beyond what is demonstrated by other infrastructure owner agencies.

8. Briefly describe any challenges you expect to encounter in implementing and adopting these design practices, and how you plan to address these challenges.

Potential challenges facing statewide GUIDE implementation:

- **Resources** – Full time technical personnel will need to be dedicated to the GUIDE program. After the evolution of GUIDE, from pilot to proof of implementation, and preparing for a statewide program, additional resources will need to be allocated to successfully implement and maintain a statewide program.
- **Utility Resistance** – MDOT is coordinating the GUIDE development with the MUCC. Development was been open and transparent. Although unexpected, there is a potential for utilities to resist providing the required GUIDE data. Full GUIDE implementation may need legislative action. Michigan has a newly established 21st Century Infrastructure Commission charged to identify the current state of the assets of transportation, water, sewer, energy, and communications. Required GUIDE program participation could be a suggestion to the commission.
- **Varying Standards** – Statewide standardization is critical to the GUIDE program's long-term success. If GUIDE expands beyond MDOT, and other agencies begin requiring accurate geospatial data on underground utility installations, these agencies will need to fully adopt the GUIDE process, data format and structure requirements. Not having statewide standardization will create an undue burden on utilities due to compliance with multiple data standards and processes across the state. MDOT has recommended other agencies continue to let MDOT properly refine the GUIDE process so in the future, the MDOT GUIDE standard could be the sole statewide referenced standard.
- **Legal Considerations** – Technology and the evolution of data sharing has largely outpaced the legal community's ability to evolve precedent and uniform requirements to deal with legal aspects of data ownership and sharing of digital

information. MDOT will engage its counsel on this topic in advance of full implementation as well as MUCC membership to vet draft legal requirements.

**As a reminder:**

1. Review all background information located on this product bundle's application page.
2. Once you have completed this form and secured the required [Leadership Endorsement Letter](#), return to application page and complete the contact information fields.
3. Upload this form and the [Leadership Endorsement Letter](#) to the page. **Be sure you are attaching the form to the correct application page.**
4. Click "Submit." You will then receive an email confirmation that includes the uploaded endorsement letter and application form.
5. Application period will close April 29, 2016.

For more information or to find this product bundle's application page, visit the [Implementation Assistance Program Web page](#).

## Appendix E

### Bug & Enhancement List

## GUIDE Bug/Enhancement List - Revised September 19, 2018 (Lefke)

### necessary/simple bug fixes and enhancements

Item Number	Bug or Enhancement	Description	Who Can Fix	Estimated Hours	Notes	Priority TBD
1	Bug Collector	<p>Collector for ArcGIS app Sync error on all operating systems.</p> <p>The offline sync does not work as documented in conference calls and P&amp;N monthly status reports.</p> <p>We first tested the offline sync mode and found that it is not working properly. All indications on the tablet showed that our data had been synced. However, after logging into the online web portal we were not able to see the pins that I had uploaded. Somehow these are not actually uploading to the server even when collector for ArcGIS indicates that they have. Collector for ArcGIS however never switches back to the live map. The map remains as if it is still waiting to sync the changes.</p>	MDOT & possibly DTMB	6 (0 - if completed)	Joe fixed 8-27, no comment from P&N or Spicer	
2	Bug Web Portal	<p>Download data widget error in the web portal.</p> <p>The download functionality at present does not work. Requests are issued and the status wheel spins without any feedback or conclusion.</p> <p>Downloading data from the website also does not work. We believe this is being worked on and should be a top priority.</p>	DTMB	6	Based off P&N's 8-17 update, this appears to be resolved	



3	Enhancement Web Portal	Adding a step-by-step prompt for the upload process.	MDOT	1.5	Included in web portal as help button - based on P&N's 8-17 update, access is denied? Joe to look into.	
4	Enhancement Web Portal	Data enhancement: In the "Company Collected By" field, it would be ideal to have a domain. We saw inconsistencies even among our own staff (i.e. P&N, Prein and Newhof, Prein&Newhof).	MDOT	3	Completed	
5	Bug Web Portal	On the "Download GUIDE Data" tool, there is a field labeled Spatial Reference*. This field is a text box with "Same as Input" entered by default. This should be a pulldown giving the user to select the spatial reference frame OR preferably this is removed and replaced with a note that states the data is being downloaded using the same spatial reference frame as it is stored on the MDOT server which is Michigan State Plane Coordinate System (NAD'83(2011)), xxxxx Zone, with elevations on NAVD'88 datum, and all units are international feet. The intent of this field is to give the user the option to select a different reference frame. This may be useful if they are downloading data that crosses state plane zones. Maybe the data is in Michigan Central, but my project is in Michigan South, so I want to download the data in Michigan South. Seems easiest to remove the field and replace with a note. Low priority.	DTMB/MDOT	1.5	Completed	
6	Bug Web Portal	Along with increased error reporting it <b>may be beneficial to included common formatting issues in the manual</b> so that users know what to look for when receiving a specific error. Such as a simple tip to check for spaces in the data that may be invisible at first glance in their csv file.	P&N and/or Spicer Group	1	P&N / Spicer to perform at complete of 2018 data collection	

## enhancements that can be added with moderate time involved

Item Number	Bug or Enhancement	Description	Who Can Fix	Estimated Hours	Notes	Priority TBD
7	Enhancement Web Portal	<p>Adding a progress and status bar in the upload process</p> <p>Improve the overall speed for csv/shapefile uploads, or if there is nothing that can be done, provide more feedback during geoprocessing (i.e. "Now processing step 1 of 5..." or a progress bar).</p>	DTMB	6	Determined functionality is not available commercially off the shelf	
8	Enhancement Web Portal	<p>Adding more detailed error messages to the upload widgets</p> <p>When uploading a CSV that may have values that differ from a pin stored in the portal, offer a more detailed explanation of the exact field value(s) that do not match. This will significantly reduce the amount of time users potentially spend in troubleshooting their data discrepancies. Example of current error: No one-to-one match found for AssetID ('Sanitary Sewer', datetime.date(2017, 5, 17), u'CK', u'SS10'). The upload survey data using a CSV file seems to work well when done correctly. This area requires that the attributes collected in the field and in the office match up exactly for it to seamlessly upload the data to the server. The error messages need to be add clarity to potential problems with files. Maybe a check for each column so for instance if the surveyor's initials attributes do not match a resulting error will come back and say that the surveyor's initials are not matching. The error should be able to tell the user specifically what Row &amp; Column does not match. This will help the user troubleshoot their csv file more effectively. This will require significant coding of specific if/then statements to check for various conditions.</p>	DTMB	8	CSV verses Shapefiles - P&N and Spicer both are recommending ONLY Shapefiles moving forward. The opportunity for errors using CSV is problematic.	

		High priority. Greatly expand on the error reporting when a CSV file or SHP file are uploaded and there are deficiencies in the files.				
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**involves research and potentially larger amount of time**

Item Number	Bug or Enhancement	Description	Who Can Fix	Estimated Hours	Notes	Priority TBD
9	Bug Web Portal	<p>If possible, correct the issue with features not showing their true shape/length when uploaded. According to past discussions, features are successfully stored in the database but do not display correctly in the ArcGIS Online map.</p> <p>Uploading a shapefile seems to need some more programming help in our opinion. Every time you upload a shapefile it will give you the preview of the file. The software will place the preview in the wrong location (within 5 feet) and it will be generalized giving it a low detail appearance. We believe the software is just taking the first and last point and creating a line between them to show you the general location of your data for a preview. This is not the issue, although users would prefer to see the entire geometry during preview. The main issue is after you execute your shapefile upload the geometry remains the same as the preview and we believe it is also storing this geometry like this in the database which is not correct. The CSV upload preview and final view of the data looks perfect so this leads us to believe that even after the data is in the database regardless of CSV or shapefile upload it should be displaying the same way. This should be a high priority fix.</p>	DTMB	6 - 10	occurring for shapefile upload	

not feasible at this time						
Item Number	Bug or Enhancement	Description	Who Can Fix	Estimated Hours	Notes	Priority TBD
10	Enhancement Web Portal	After the user is informed that their features have correctly been imported and are being shown in preview mode, the final command to publish the features should appear on the Output tab. The manual does a good job informing users that they must return to the Input tab, uncheck "InPreviewMode" and click "Execute" again, but I found this workflow somewhat choppy in having to go back and forth between tabs. From a usability standpoint, perhaps a wizard-like interface might be more efficient with a step by step approach as opposed to the 2 tabs. Step 1 would be upload the csv, step 2 preview the features, step 3 execute final database update if features are correct.			not feasible	
11	Enhancement Web Portal	Overall speed improvements.  One of the concerns we have is the current performance of the Web Portal site. It's concerning that there is very little data in the database and performance is so poor. It seems like performance will only continue to decline as more data and more users are hitting the site. Lower priority on this fix at this time, but will ultimately need addressed.			not feasible at this time	
12	Enhancement Collector	Would like to have "conditional visibility" for fields. For example, if the feature does not have an encasement then none of the encasement fields will be visible.			not feasible; AGO technology is not this robust yet	



13	Enhancement Web Portal	Allow a user that uploads data to also delete their own data if it is less than 24 hours old. This would allow users to fix any issues that they see in their data after upload. Right now if the file passes all checks and uploads, the only way to correct the file is to have MDOT delete the data so the user can re-upload the file. Once the data is a day old it will be locked into the system and cannot be deleted by users.			not feasible at this time	
14	Enhancement Web Portal	A couple down the road improvements could be the utilization of 3D underground visualization utilizing Web Scenes in ArcGIS Online.			possible future enhancement	

miscellaneous						
Item Number	Bug or Enhancement	Description	Who Can Fix	Estimated Hours	Notes	Priority TBD
15	General	NMEA support and high accuracy receivers. With Collector for ArcGIS now supporting NMEA output, what considerations need to be made moving forward for this type of data collection? This could potentially save users significant time, but clearly would dramatically change the current workflows in place. One of the benefits of the existing workflow is that it has QA/QC built-in. Collecting data in the field, then uploading gives the user the chance to review data and make necessary corrections. Conversely, it requires multiple steps. Collecting high accuracy data in the field directly through Collector could potentially increase efficiency, but the backend processes would have to change to account for this.	MDOT	small	Could eventually replace the need for CSV upload	